

WHAT MATTERS IN SELF-DIRECTED LEARNING AND COLLABORATIVE LEARNING?

**A collaborative project initiated by Singapore Ministry of
Education and National Institute of Education.**

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Foreword

It started with a simple idea about doing what we preached, that rather than just writing about collaborative and self-directed learning, the tenets of the 3rd ICT Masterplan for Education, it would be better to capture and refine these ideas through a collaborative online environment. To bring this about, a team was formed, as reflected in this report, to formulate and eventually establish an environment to facilitate the conversation that leads to this report.

This exercise proves to be an enriching experience for all involved, as apart from the meaningful sharing of ideas that ensued, the process itself brought home the realities of collaboratively generating and sharing ideas in the New Media environment. It allowed us to experience firsthand how such communities can produce ideas that are greater than the sum total of the individuals. To this end, it is important to gratefully acknowledge the work of the team that has brought this about.

This collection of ideas has, to a good extent, brought about greater clarity on collaborative and self-directed learning, and how these competencies can be gainfully developed and applied within various teaching and learning context. However, these ideas are dynamic in nature, especially when teaching and learning interactions will necessarily evolve with time and injection of new technologies. As such, this report is at best a snapshot in time about how we think about the topics at hand; but could, hopefully, present a good platform to help shape the development of these and other similar ideas in the future.

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WHAT MATTERS IN SELF-DIRECTED LEARNING AND COLLABORATIVE LEARNING?

Results of an adapted Delphi-based Study

Executive Summary

The purpose of this collaborative project is to co-develop ideas about theoretical constructs and practical implications of self-directed learning (SDL) and collaborative learning (CoL) with technology. SDL and CoL are the two main constructs foregrounded as desirable educational outcomes in Singapore Ministry of Education's Third Masterplan for ICT in Education (MP3 hereinafter). The key objectives of this project are:

- To **discuss** and **identify** key aspects of self-directed learning (SDL) and collaborative (CoL) learning to enhance their understanding and application in schools;
- To **problematis**e the definitions and explanations of identified key aspects of SDL and CoL against a backdrop of schools' common practices of curriculum design and implementation;
- To **extract** feasible ideas of curriculum design with elements of SDL and CoL and to study its implementation possibilities and effectiveness in schools.

An adapted web-based Delphi process was used to capture the judgment of recognized experts in the field of learning sciences. Generally, the Delphi technique is used to systematically solicit and collect judgment among experts on a particular topic toward consensus building. The Delphi technique is considered as a time and cost-efficient method to overcome implicit weaknesses in face-to-face group communication, such as confrontation, argumentation, or dominance by a few individuals. We modified the traditional Delphi method (a) by combining group discussion and individual surveys, and (b) by utilizing the affordances of Web 2.0 technologies.

Based on the opinions and voting of the experts, the top 3 fundamental elements for SDL in the context of K-12 education are:

- 1) Personally and socially meaningful goals
- 2) Self-sustaining interests for learning
- 3) Support for self-monitoring and assessment

The top 3 important conditions for CoL are:

- 1) Individual and group accountability of learning
- 2) Effective group processes
- 3) Effective activity design

On the issue of nurturing SDL and CoL practices effectively in a classroom, there are many challenges that the schools and teachers have to overcome in order to achieve SDL and CoL. Teachers are generally constrained by their understanding and capacity of TPCK (Technological Pedagogical Content Knowledge) and assessment, school social infrastructure, and staff appraisal and reward systems. Therefore, it will require a systemic change to the learning and appraisal cultures of a school system to be able to transform sustained practices that can and will actually be enacted by teachers.

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Introduction

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The project was conducted from 6 April to 22 August 2010 according the following three phases:

Phase I: Formation of the Project Advisory Board (6 to 24 April 2010)

Potential advisory board members well known in the field of learning sciences were nominated by the researchers from the Learning Sciences Lab, and were invited to participate in the project via email. Appendix A shows the list of the Advisory Board members (hereafter referred to as experts) who accepted the invitation and participated in this project.

Phase 2: Wiki Discussion (20 May to 20 July 2010)

A wiki space (<http://sdlandcol.wikispaces.com/>) was created to stimulate productive dialogue among local and international researchers who accepted the invitation. The following three research questions were posted in the wiki space:

Research Question One

What are the scaffolding or conditions teachers need to provide that will support students' learning experiences when using technology for:

- self-directed learning?
- collaborative learning?

Research Question Two

What would you suggest as possible professional development models or scaffolding needed for teachers to create the self-directed and collaborative learning experiences when using technology for students?

Research Question Three

What do you see as the key challenges related to learning and teaching that schools will face in designing self-directed and collaborative learning experiences using technology for the students?

This wiki space was facilitated by a team composed of members from the *Education Technology Division* (Ministry of Education) and the *Learning Sciences Lab* (National Institute of Education) (see Appendix B for the members of this team). The Advisory Board members were provided with background information about the third Masterplan and other literature related to the discussion topics.

Phase 3: Individual Survey and Consensus Building (25 July to 10 August 2010)

The purpose of this last phase was to consolidate discussion points and to facilitate a consensus building process. After the closure of the wiki discussion phase, the project team identified and consolidated key ideas emerged across discussion topics (see Table 1). Individual online surveys containing (a) the list of consolidated discussion points on SDL and COL and (b) the list of fundamental elements and conditions for SDL and COL were sent to the Advisory Board members for further comments and ranking. The rankings from the 12 members (hereafter called experts) were then compiled into a collective set of responses.

Table 1. Fundamental Elements of SDL and COL

SDL	COL
<ul style="list-style-type: none"> • Management of learning tasks • Personally and socially meaningful Goals • Self-sustaining interests for learning • Flexibility in curriculum content and teaching practices • Support for self-monitoring and assessment 	<ul style="list-style-type: none"> • Effective group processes • Individual and group accountability of learning • Teacher communicates expectations clearly • Assessment using effective tools • Effective activity design • Collaboration scripts for teacher and students • Ground rules for collaborative scaffolding

Findings on Self-Directed Learning (SDL)

Fundamental Elements of SDL

In phase 3 of the project, the 12 experts voted for the fundamental elements of SDL in terms of importance. The results are as shown in Figure 1:

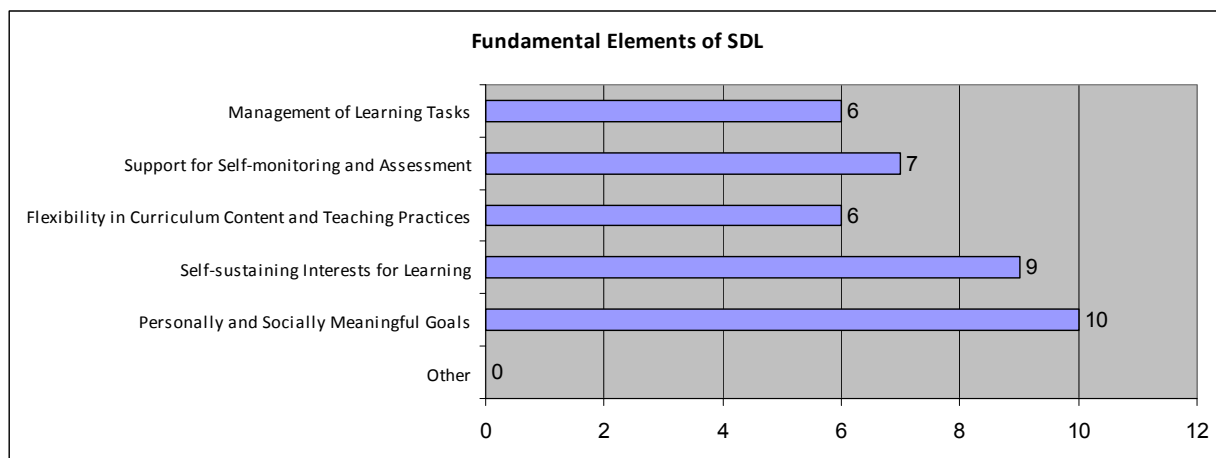


Figure 1. Voting results for fundamental elements of SDL

It is shown that the top 3 fundamental elements for SDL are:

- 1) Personally and Socially Meaningful Goals (10 of 12 votes)
- 2) Self-sustaining Interests for Learning (9 of 12 votes)
- 3) Support for Self-monitoring and Assessment (7 of 12 votes)

Personally and Socially Meaningful Goals

The notion of students possessing learning goals that are personally and socially meaningful to them is closely tied to students' intrinsic motivation of learning, self-efficacy and meta-cognition. It was agreed that a didactic and test-dominated curriculum would not afford much room for students to develop personally and socially meaningful goals. Rather, it tended to provide or support extrinsic goals of learning (e.g. students do the work because it is mandated in the curriculum or learn to the test).

There was a need to look at how the current curriculum could be intelligently tweaked to afford more exploration and choices for students to do meaningful goal setting. For example, setting goals would make more sense when students were doing more project-based learning with multiple lines of inquiry.

Self-sustaining Interests for Learning

It was agreed that SDL would be incomplete if the informal learning component was not taken into consideration. Helping pupils to develop self-sustaining interests for learning could start within the formal curriculum. A curriculum with a heavy emphasis on didactic instruction would tend to breed pupil dispositions to see learning as memorization, rather than understanding. Thus, the teacher had the important role of guiding students to make meaningful connections between their informal learning and their knowledge learnt through the formal classes.

In the Singapore context, it was suggested that there was very little room for informal learning. Even after school, the students' time was filled with the extension of the formal learning mode,

such as going to tuition centers and private tutoring. Under this culture, it seemed quite challenging to help and motivate students to develop "dispositions" toward self-sustaining interests.

Support for self-monitoring and assessment

It was agreed that ICT tools could support processes of self-monitoring and assessment. Examples of ICT tools provided were automated assessment/analysis tools embedded in Knowledge Forum (<http://www.knowledgeforum.com>) that helped students to monitor how they were learning, collaborating and participating. Facebook and blogs were also used extensively by a school to capture the progress of students' learning.

It was felt that more research would need to be done in this area. A challenge of using existing ICT tools was that they were often tied to particular software environments and were not shared. As a result, there were not usable enough as valid frameworks of referencing to interpret interaction data automatically collected (e.g., how dense a network is dense enough?).

Besides the top 3 conditions voted by experts, they identified other important elements of SDL as follows:

Management of Learning Tasks

There was consensus on the management of learning tasks as an integral component for SDL. More often than not, the teacher would need to provide the necessary scaffolding and support to ensure that students can meaningfully manage their learning activities.

The appropriate use of ICT tools such as 1:1 devices and web 2.0 tools could serve to foster SDL. One example provided was Learning Sciences Lab's (LSL) Seamless Learning Project. Researchers and teachers transformed a few topics in Primary 4 science curriculum into one that can be delivered using the affordances of mobile technologies. A class of Primary 4 Students from Nan Chiau Primary School was equipped with HTC smart-phones and GoKnow

software for 24/7 access. The mobile device became a learning hub for their learning (Zhang et al., 2010). They used mobile KWL to manage their learning. The text input and camera video features were tapped to collect and store the data. These learning artifacts were then shared online with other students.

The following challenges to management of learning tasks need to be addressed by further research and design efforts:

- What can be done to encourage students to maintain a continuous focus on an inquiry for a necessarily long period to achieve enough depth?
- How do we know that students have internalised the practice and found it rewarding in their learning pursuits?
- How do we know that such SDL practices could lead to tangible learning gains?

Flexibility in Curriculum Content and Teaching Practices

There is consensus that didactic forms of instruction would lead to an emphasis on memorization rather than affording the kind of flexible learning needed. The question was raised as to the amount of room to be given to students for self-directed learning when preparations for examination were also critical in local schools.

In giving students greater agency for learning, the point was put forth that it was not about structured versus unstructured learning. More importantly, it should look into how teachers and students could co-structure learning in meaningful ways. That is, student-directed learning and inquiry would require more emergent structures, less imposed structures, with students and their teacher co-designing and controlling the classroom flow through an interactional process. These interactions would then lead to unfolding sustained inquiry driven by student ideas and supported by adaptable teaching practices

Findings on Collaborative Learning (CoL)

During the wiki discussions, the local and international experts discussed the 3 questions about collaborative learning. The main themes surfaced in the discussions are the constructs of collaborative learning, conditions/scaffolding for teachers to foster collaborative learning, professional development for teachers, and challenges of collaborative learning.

Conditions/ Scaffolding for Fostering CoL

In the phase 3 of the project, 12 experts voted the fundamental Conditions for CoL in terms of importance. The results are shown in Figure 2.

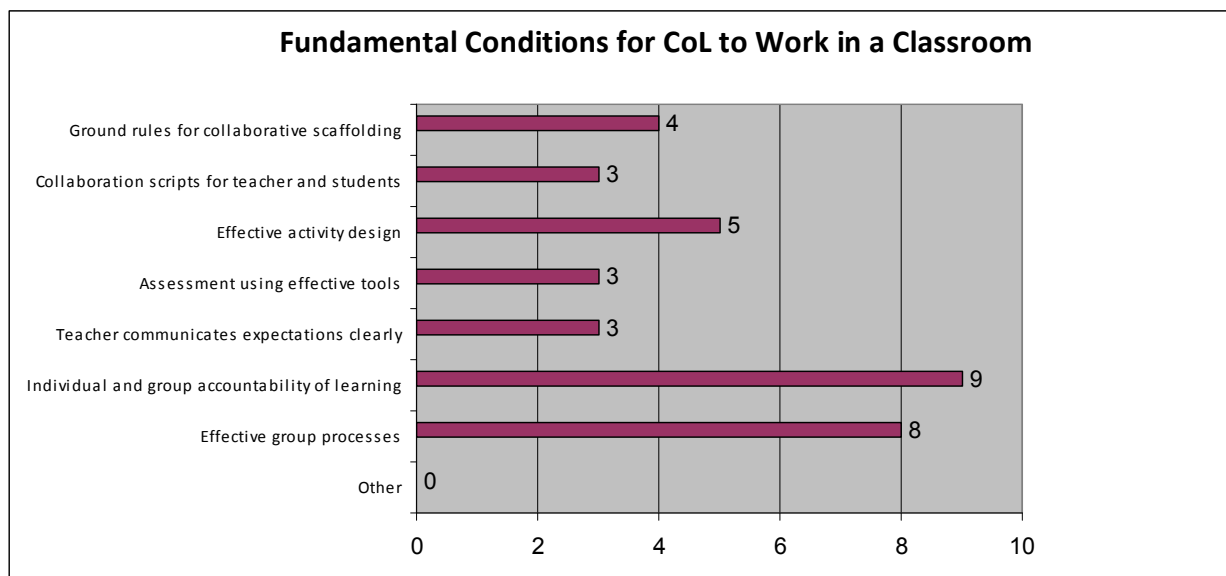


Figure 2. Voting results for fundamental conditions for CoL

It is shown that the top 3 important conditions for CoL are:

- 1) Individual and group accountability of learning (9 of 12 votes),
- 2) effective group processes (8 of 12 votes), and
- 3) effective activity design (5 of 12 votes).

Effective group processes

It was opined that a more realistic picture of Collaborative Learning (CoL) should be painted as compared to what was provided in the scenario. While there could be a great degree of harmony in CoL, it could also be full of disagreement. Research was also cited to show that students might not be motivated to contribute new ideas or know exactly how to collaboratively effectively search for or use the relevant information. A more realistic description of CoL would be needed to help teachers gain a better understanding of how to design for productive collaborations among students and the kind of interactions to look out for.

There was also a suggestion to look at the construct of effective group processes in more principle-based terms:

- (1) Awareness of contributions – To be aware of what has been contributed and what are the gaps in knowledge that have yet to be addressed
- (2) Complementary contributions – To respond and build on one another's ideas such that non-redundant and important information and knowledge are contributed to advance learning as a whole.
- (3) Distributed engagement – To empower students to work with goals that emerge from their interactions and correspondingly initiate new, extended lines of discourse, instead of only responding to questions and tasks generated by their teacher

Individual and group accountability of learning

A common problem noted in group-work context was the tendency of students to “free-ride on other students” or take a “divide and combine” approach. In order for students to truly engage in collaborative learning opportunities, it was suggested that the construct be expanded to include a collective and communal aspect. That is, accountability must be built in for members to make aligned, connected and complementary contributions that would advance collective understanding rather than merely complete the group tasks.

The use of Creative Commons (CCs) (<http://creativecommons.org>) in the wiki space was quoted as an example of how to foster more active student contributions in collaborative work. Positive interdependency among team members could be enhanced by CCs because it provides a mechanism to protect individual creations while encouraging more remixing to derive new creations. It was found that CCs potentially improved participants' attitude to the derivative works, the satisfaction level of remix outcomes, perceptions of the peer interactions and the sense of work ownership.

It was opined that there must be an understanding in the difference between collaboration and cooperation. The suggested definitions were that the objective of cooperative learning is to attain instructional goals through work in small groups and that the characteristic of group work methodologies is the defining of role of the group participants and the tasks they must execute in pursuit of these goals. Collaborative learning objective on the other hand sought to promote positive interdependence and individual responsibility among group participants in reaching a goal shared by all of them. It entails methodologies that enable the participants to comprehend the goal of an activity through interaction and negotiation of their individual perspectives.

Effective CoL activity design

Experts proposed that the CoL activity design should provide intellectual, social and emotional support to help learners move forward in their learning so that once these supports are removed, the learning is secure. The design should foster individual and social processes and outcomes. It is necessary to encourage the building of relationships and communication with others through the learning objective that assist in the mutual construction of knowledge in order to enhance the achievement of the group and its peer members. The activity design needs to promote the active engagement and responsibility of learners. The promotion of learners' independence and autonomy through the acquisition of a set of learning strategies and practices that enables them to be agents in their own learning is an objective. The

reciprocal teaching (Palincsar & Brown, 1984) was cited as an example of effective CoL activity design.

There was a common understanding on the importance of collaboration between researchers, teachers and curriculum experts in order to have an effective activity design. The example of 'researcher-teacher' co-design model for LSL's Group Scribbles project was cited. Having said this, it was opined that it is impossible to design a perfect activity all the time as learning is supposed to be messy and challenging and requires considerable conversation amongst the stakeholders in order to clarify goals and expectations.

Besides the top 3 conditions voted by experts, they identified other important conditions for fostering CoL as follows.

Shared expectations and norms

Experts pointed out that there need to be shared expectations and norms so as to scaffold desirable interactions. It is not a sufficient condition but a necessary one. The emphasis was that these expectations and norms should be co-constructed by all the stakeholders within the classroom instead of just the teacher. This would ensure that students work closely with their teachers to clarify expectations, goals and instructions. The clear setting of expectations and norms would also help students to communicate more effectively with others and be more involved and responsible for their own learning. Additionally, it was recommended that explicit or implicit conveying of CoL ground rules or strategies may be needed for younger students.

Ground rules for collaborative scaffolding

Working collaboratively may not be a spontaneous response to working in a group. Teaching learners how to collaborate is a necessary part of the process of learning collaboratively which can enhance outcomes further (Nussbaum et al, 2009). It was generally agreed that ground rules for effective collaboration are needed. However, certain conditions must be met first in order to make it more beneficial. For example, the students must understand the benefits for

collaboration. They could formulate their own ground rules after collaborative work so as to have a greater sense of ownership and accountability of their own actions. The teacher, serving as a partner, can then build onto these ground rules to add those which might be necessary for effective group work. Additionally, the students could also be acculturated into the process of working together from an early level of schooling.

It was also opined that although the set of rules could be useful for practitioners, the real challenge would be to prepare teachers to address the unexpected, the unplanned, the problems and challenges.

Collaboration Scripts for Teacher and Students

The notion of scaffolding teachers with 'best CoL practices' scripts (which can be faded out at a later point in time) that are conducive to classroom and peer-group interactions, was discussed. It was opined that although some novice teachers would greatly benefit from the use of collaboration scripts to implement CoL activities, having a script may limit the creativity of these teachers in designing meaningful CoL activities. We should avoid “over-scripting” in CSCL because of the different contexts of classrooms (such as group dynamics and teacher differences) (Dillenbourg, 2002).

A suggestion was made to provide videos on best practices in the conducting of CoL activities and principles of effective CoL activity design and implementation. It was further mentioned that real learning is learning to deal with the unanticipated, the unexpected and the problems that might crop up later. One researcher argued for principle-based collaboration rather than procedure-based, prescriptive collaboration (step-by-step scripts) from. The latter might be easier for novice teachers and students, but the former is essential for evolving an authentic dynamic culture of COL and knowledge creation.

Assessment using effective tools

Experts proposed to have appropriate assessment using effective tools (e.g., Web 2.0 tools, semantic analysis tools, social network analysis tools) as a summative assessment platform to advance CoL as well as to determine whether good CoL has occurred. The tools can help teachers to diagnose learning difficulties and monitor students' CoL processes and products. Besides, the self-evaluation features of the tools can help students to check and monitor their learning progress, provide feedback to students, help them check their results or have prompts to guide them to think better. An example of such a tool was the Teachable Agent of Stanford University Dan Schwartz's group. It was also mentioned that automatic online-assessment of text quality and awareness systems which captured how things work with whom, could be used to promote reflection and implicitly guide the learning process. The common underlying thought regarding this section was that more research was needed in order to better understand the effective assessment of CoL.

Learning resources

The importance of learning resources for teachers cannot be overstated. Collaborative patterns and design principles on how we can design classroom collaboration in different subjects are a tremendous help to beginning teachers to start some of these practices. The goal is for teachers to understand these principles and design/enact new collaborative activities on their own. It was unanimous that the provision of such resources facilitates CoL processes. It was mentioned that sharing of these resources through a common platform, such as 'edumall2.0' (<http://www.edumall.sg/>) can be very useful and to further encourage sharing amongst the teachers. Credits or awards could be given to teachers who shared good lesson resources and to encourage more teachers to do so. Moreover, these resources should be adaptable and customizable in order to meet the diversified needs of students. An example of good learning resources cited was the Knowledge Building Teacher Network hosted at the University of Hong Kong.

CoL research & practice in holistic and systematic way

Some experts identified the need to address the difficulty of engage students in authentic CoL by looking at larger social contexts/ dynamics of CoL in a holistic and systematic way - design, implement and analyze CoL from multi levels (small group collaboration, whole classroom collaboration, CoL across grade levels and across classrooms/ communities). It was opined that this critical area needs further research, specifically in the area of effectively teaching CoL. It was mentioned also that this construct required a cultural, knowledge and belief change especially in the Singapore system. With a meritocratic system, individualism might outweigh collaboration since self-interest and the quest to improve oneself takes precedence over the group's interest. An example was given to show "across classroom, across-school year build on" (Zhang & Messina, 2010; Zhang & Sun, in press).

Professional Development for Teachers

Teacher learning is perceived to be crucial in the implementation of SDL and CoL. Equipping teachers through courses and teacher training is seen as essential. It was highlighted that due to the varied demographics of teachers such as willingness to learn, understanding of pedagogy etc., conducting such preparation courses would be a challenge itself. An emphasis was mentioned in that in-service teacher training should not be neglected and should instead, be given more attention. This is because in-service teachers might not be equipped with the set of skills essential for the 21st Century. Pre-service teachers might be better prepared since the teacher training they have to undergo would be more updated. It was opined that further research on effectively equipping and preparing teachers is essential.

It was opined that for teachers to teach CoL, they must first experience all elements of CoL. This is so that they would be able to understand, reflect and embrace what CoL entails, and eventually able to design and carry out CoL lessons. Beyond the individual level efforts, teachers can form study group or work as a community of practice that substantially advances and supports each teacher's learning and practice.

It was viewed that conducting CoL lessons would require the teachers to fundamentally change their belief systems on teaching and learning, and that they would have to spend more time to design their lessons and even change lesson routines, with no guaranteed significant positive impact on their students' performance. Against the backdrop of heavy workload and pressure on getting high grades in school exams, getting the teachers to conduct CoL lessons would be a great challenge. It was raised that they have to be convinced of support given by the school management to implement CoL in their class. It was suggested that incentive schemes could be put in place to reward or recognise the efforts of these teachers. Another suggestion was to get "progressive-minded" teachers to set the example so that they would be able to generate success stories and inspire the other teachers to implement CoL.

It was also opined that a professional learning network be set up to support teachers in their efforts. Reasons being that teachers' development need a broad community of support, and also in recognition that teachers are busy and that meeting need to take place virtually and at odd hours.

Challenges of nurturing SDL/CoL practices in classrooms

For SDL and CoL practices to take place effectively in a classroom, there are many challenges that the schools and teachers have to overcome in order to achieve good SDL and CoL outcomes. Teachers are generally constrained by their understanding and capacity of TPCK and assessment, school infrastructure, and how they will be "appraised". Therefore, it will require a systemic change to the learning and appraisal cultures of a school to transform sustained practices that will actually be implemented by teachers.

Inflexible curriculum and materials

Teachers need to have the capacity to balance between content flexibility and curriculum needs within a formal education system. Teachers should also be able to work with curriculum content in a cross-disciplinary, multiple-perspective, learner-centered way. Only then, they could design, integrate and scaffold their lessons such that students could have the opportunities to go 'deeper' and 'appreciate' the inter-connectedness of the subject areas they are learning.

A big challenge for CoL project in Singapore school is the structured curriculum and materials. In many cases that besides the designed ICT-based curriculum, teachers still want to students to follow the existing curriculum, materials and worksheets, which makes the ICT lessons an add-on rather than essential for students.

Constraints of logistics, time tables, and learning spaces

Presently, the way Singapore schools organize learning space and time is not particularly conducive to CoL. While a smaller class size may help the interactions in classes, it is also important to give more preparation time for teachers. In China, although there are more students (e.g. 80-100 students) in each class, the teachers are given more time to prepare their lessons. Good instructional design takes time. If teachers are working like fire fighters who have

to cope with unexpected events all the time, they not going to have much effective time conducting their teaching and learning in the class.

There is a need to re-examine the relation between space, human communication and collaboration. The organisation of learning time in Singapore schools is another big obstacle. There is always a tension between covering core content in syllabus and giving a more flexibility and room for meaningful learning opportunities, which include some aspects of SDL and CoL. There needs to be some re-thinking done relating to the organisation of schools strictly be age-based cohorts rather than individual-based competencies.

One example of how it could be done is described by Learning Sciences Lab's Group Scribbles project (<http://gs.lsl.nie.edu.sg/>) in Mayflower primary school. The computer laboratory setting was changed from "rows" to "clusters" to make it more conducive for CoL. Another possible example can be found in Zhang et al. (2009). When planning and facilitating knowledge building, the teacher first identifies the big ideas and important problems in a domain as well as possible connections with related areas. He imagines the knowledge building process in an open way, and engages student collective responsibility to evolve specific goals and processes. The teacher focuses on understanding the evolution of student thinking, bringing important new ideas emerged in the community space to student focus, "stirring the pot" by asking stimulating questions, and facilitating meta-discourse about what they have achieved and what needs to be done. With the adoption of opportunistic-collaboration comes the teacher's deep understanding of the progressive and unfolding nature of curriculum.

Lack of tools for assessment/monitoring/feedback for teachers to effectively measure CoL

Competencies on using these assessment/monitoring/feedback tools for SDL and CoL are still largely lacking or not fully understood by the teachers. The ability to use these tools effectively follows from the teachers' understanding. Researchers may have the time, resources and expertise to analyse classroom data for SDL and CoL. However, teachers cannot be expected to perform such analysis for their many classes and students in a routine way. Teachers are not

researchers. The teachers have their strengths, but they may not want to be a researcher, or even an action research researcher. This brings challenges for teachers to embrace CoL and SDL to any meaningful extent when operating within a system that picks up only academic performances. One possible solution is to provide graduate programmes or training for the teachers to enable them to be able to apply the tools to assess/monitor/feedback on SDL and CoL.

General gap of how CoL looks like for a large range of subject areas.

There is still a general gap of how CoL could look like for a large range of subject areas. Such a pool of good practices will need to be built up over time to sustain the adoption of SDL and CoL on a long term basis. There is also a need to provide a platform for teachers to experiment and develop such practices at the school level. One example in Singapore is the 'EduLab'. It serves as a major conduit through which ideas can be brought into practice and aims to achieve the following objectives:

- a. draw ideas with system-wide potential from the ground;
- b. develop concepts derived into ICT-infused lesson and product prototypes; and
- c. prepare innovations to be scaled to a wider segment of the school community.

It is important to note that sharing best practices among teachers has been a long-lasting topic in teacher educational research. While technology seems promising in this role, many attempts to help teachers share their practices using technology-based platform have not been successful or sustained. One possible reason is that still sharing practices with colleagues or even with a larger community is not a dominant culture among teachers although they might see the positive side of doing it.

School-wide cultural and system change takes time. Without these sharing and knowledge of how CoL processes can take place in many subject areas, teachers are faced with great challenges to enact such practices in their classrooms.

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Appendix A: ADVISORY BOARD MEMBERS

Listed in alphabetical order

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Hiroaki Ogata	University of Tokushima, Japan
Jun Oshima	Shizuoka University, Japan
Peter Reimann	Sydney University, Australia
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Hyo-Jeong So	Nanyang Technological University, Singapore
Elliot Soloway	University of Michigan, USA
Karl Steffens	University of Cologne, Germany
Ravi Vatrappu	Copenhagen Business School, Denmark
Lung-Hsiang Wong	Nanyang Technological University, Singapore
Baohui Zhang	Nanyang Technological University, Singapore
Jianwei Zhang	University at Albany, State University of New York, USA

Appendix B: FACILITATORS OF THE WIKI SPACE

Listed in alphabetical order

Meng Joo Chua	Ministry of Education, Singapore
Seau Yoon Foo	Ministry of Education, Singapore
Ken Leong	Ministry of Education, Singapore
Jeffrey Looi	Ministry of Education, Singapore
Wen Li Chen	Nanyang Technological University, Singapore
Chee Kit Looi	Nanyang Technological University, Singapore
Hyo-Jeong So	Nanyang Technological University, Singapore